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INSPECTION OF FUEL STORAGE TANKS
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API 570	(2016, 4th Ed) Piping Inspection Code: In-Service Inspection, Rating, Repair, and Alteration of Piping Systems
API RP 1110	(2013) Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids or Carbon Dioxide
API RP 571	(2011; 2nd Ed) Damage Mechanisms Affecting Fixed Equipment in the Refining Industry
API RP 2207	(2007; R 2012; 6th Ed) Preparing Tank Bottoms for Hot Work
API RP 574	(2009; 3rd Ed) Inspection Practices for Piping System Components
API RP 575	(2014; 3rd Ed) Inspection Practices for Atmospheric and Low-Pressure Storage Tanks
API RP 579-1	(2016) Fitness-For-Service
API Std 2015	(2014) Safe Entry and Cleaning of Petroleum Storage Tanks
API Std 650	(2013; Errata 1 2013; Addendum 1 2014; Errata 2 2014) Welded Tanks for Oil Storage
API Std 653	(2014) Tank Inspection, Repair, Alteration, and Reconstruction

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 37-14	(2015) Design Loads on Structures During Construction

ASME INTERNATIONAL (ASME)

ASME B16.48	(2015) Line Blanks
ASME BPVC SEC IX	(2015) BPVC Section IX-Welding and Brazing Qualifications
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME BPVC SEC V	(2015) BPVC Section V-Nondestructive Examination

ASTM INTERNATIONAL (ASTM)

ASTM A370	(2014) Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM D610	(2008; R 2012) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM E1316-14	(2014) Standard Terminology for Nondestructive Examinations
ASTM E2807-11	(2011) Standard Specification for 3D Imaging Data Exchange
ASTM E2862-12	(2012) Standard Practice for Probability of Detection Analysis for Hit/Miss Data
ASTM E329	(2014a) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
ASTM E543	(2015) Standard Practice for Agencies Performing Non-Destructive Testing

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 306	(2014) Standard for Control of Gas Hazards on Vessels

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 2	(2015) Measurement of Dry Coating Thickness With Magnetic Gages

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-222	(2009g; Add 1 2007; Add 2 2009; R 2012; R 2013; R 2014) Structural Standards for Antenna Supporting Structures and Antennas

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements

Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

FC 1-300-09N	(2014) Navy and Marine Corps Design Procedures
MIL-HDBK-1823A	(2009) Nondestructive Evaluation System Reliability Assessment
UFC 3-460-01	(2010; Chg 2 2015) Design: Petroleum Fuel Facilities
UFC 3-460-03	(2003) O&M: Maintenance of Petroleum Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1926.1400	Cranes and Derricks in Construction

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

NAVFAC P-307	(2009) Management of Weight Handling Equipment

U.S. NAVAL SUPPLY SYSTEMS COMMAND (NAVSUP)

NAVSUPGLSINST 10345.1	(2015) Fuel Tank Return to Service

1.2 DEFINITIONS

1.2.1 Hazardous Area

As used in this Section, any area within 100 feet of active storage tanks, areas within 100 feet of leaking sections of fuel pipelines or other vapor sources, areas within 200 feet of the downwind side of potential vapor emission sources (i.e., pressure-vacuum vents, sample ports, or open vents on active tanks; leaking sections of pipelines), areas within existing tanks, and areas within a tunnel or adit.

1.2.2 Hot Wo 

Hot work, for work covered by this section, includes: drilling, boring, flame heating, welding, torch cutting, brazing, carbon arc gouging, grinding, abrasive blasting, or any work which produces heat, by any means, of 400 degrees F or more; or in the presence of flammables or flammable atmospheres, other ignition sources such as spark or arc producing tools or equipment, static discharges, friction, impact, open flames or embers, nonexplosion-proof lights, fixtures, motors or equipment.

1.2.3 Inspector of Record

The individual, certified as a fuel storage tank inspector, in responsible charge of the storage tank inspection who will sign the suitability for service letter. The recognized certification is API Std 653.

1.2.4 Long Term Repair

Action intended to extend the service life of the tank, ensure continued compliance with policy, criteria, standards, and regulations, and currently has no adverse affect on tank operability or integrity.

1.2.5 Mandatory Repair

Action necessary to preserve or restore the structural and hydraulic integrity of the tank. Includes any condition which has or may breach the hydraulic or structural integrity of the tank prior to the next integrity inspection.

1.2.6 Marine Chemist

The holder of a valid Certificate issued by the National Fire Protection Association in accordance with the "Rules for Certification of Marine Chemists", pursuant to NFPA 306, establishing the individual as qualified to determine whether construction, alteration, repair, or shipbreaking of vessels can be undertaken with safety.

1.2.7 MAWP

Maximum allowable working pressure: As used in this Section, maximum internal pressure in the piping system for continued operation at the most severe condition of coincident internal or external pressure and temperature expected during service.

1.2.8 Near Term Repair

Action based on good engineering practice or compliance with policy or criteria, and which should be programmed for completion within ten years.

1.2.9 POD Analyst

The individual responsible for performing Probability of Detection (POD) analysis on hit/miss data resulting from a POD examination.

1.2.10 Progressive Indication

A response from a nondestructive examination interpreted to be relevant and evaluated to be temporal deterioration.

1.2.11 Tank Engineer

One or more licensed professional engineers, or an engineering firm, acceptable to the Contracting Officer who are knowledgeable and experienced in the engineering disciplines associated with evaluating mechanical and material characteristics that affect the integrity and reliability of storage tanks. The storage tank engineer is the tank repair subject matter expert and is responsible of all storage tank design and repair.

1.2.12 Tank Inspection

As used in this Section, a tank inspection is a multi-disciplinary engineering assessment of all petroleum, oil, and lubricant storage tank systems within or connected to the tank hydraulic boundary. Systems include nozzles, appurtenances and conveyance systems such as piping, stilling well, valve, flow control, overflow protection, spill prevention,

walkway, fire suppression, tower, bridge, catwalk, manual gauging control, atmospheric ventilation, lighting, and other electrical systems.

1.2.13 Tank Inspector

An individual certified as a fuel storage tank inspector. The recognized certification is API Std 653.

1.2.14 Tank Shell

As used in this Section, all surfaces of the tank hydraulic boundary including bottom, lower dome, barrel, extension ring, upper dome, nozzles, adjustment rings, and expansion joints.

1.3 ADMINISTRATIVE REQUIREMENTS

1.3.1 Sequencing

Schedule Probability of Detection examination activities with adequate time for the analyst to review the procedure and results, analyze data, and produce a report in accordance with ASTM E2862-12.

Schedule metallurgical testing with adequate time for receipt of results and analysis to be used in the design of repairs.

Schedule tank inspection and validation of predictive repairs to occur during the design phase of the contract.

1.3.2 Inspection Review Meeting

During the tank inspection phase, provide a weekly meeting to brief the Government on technical details of the tank inspection and non-destructive examination (NDE). Discuss progress, inspection findings, tank conditions, data quality, data management, and NDE detection uncertainty. Subcontractors performing any aspect of tank inspection, including NDE, are required to attend the meeting. The intent is an open, unconstrained discussion of the tank inspection process and data. The quality control manager will chair the meetings.

1.3.3 Safety Permits and Equipment

Acquire safety permits and necessary safety equipment in compliance with Installation Requirements, Section 01 35 26.05 20, Section 33 65 00 CLEANING PETROLEUM STORAGE TANKS, and EM 385-1-1. A permit is required for all hot work. The storage tank is a confined space and entry shall be made in accordance with requirements of EM 385-1-1 Section 34.

1.3.4 Regulatory Requirements

Obtain permits required to comply with local, State, and Federal regulations.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor QC approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the

Sustainability Notebook, in conformance to Section 01 33 29, SUSTAINABILITY REQUIREMENTS. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Tank Inspector Credentials; G

Laboratory Accreditation; G

Pipeline Inspector Credentials; G

Tank Engineer Credentials; G

POD Analyst Credentials; G

NDE Examiner Credentials; G

NDE Firm Credentials; G

Tank Plate Access Plan; G

SD-05 Design Data

Inspection Design; G

SD-06 Test Reports

NDE Reliability Report

Preliminary Inspection Report; G

Pedigree Report

Substrate Test; G

Cleaning Test Panel Results; G

Inspection Report; G

1.5 QUALITY ASSURANCE

1.5.1 Modification of Referen

Perform work in accordance with FC 1-300-09N, UFC 3-460-01 and UFC 3-460-03. Except as modified herein, work shall conform to API Std 653, API RP 575, API 570, and API RP 574. Where the word "should" appears in these publications, substitute "shall."

1.5.2 Qualification and Certification

1.5.2.1 Tank Engineer

Qualification
Minimum seven years verifiable experience in tank evaluation, design, repair, and integrity assessment on bulk fuel storage tanks. Provide evidence of having completed designs, repair designs and assessments on at least five similar tanks within the previous five years.

Certification
Licensed Professional Engineer. Knowledge of or certification as an API Std 653 tank inspector. Provide Tank Engineer Credentials and qualification.

1.5.2.2 Tank Inspector

Qualification
Minimum seven years verifiable experience performing inspections of bulk fuel storage tanks. Provide evidence of having completed inspections on at least five bulk storage tanks within the previous five years.

Certification
API Std 653 tank inspector. Provide Tank Inspector Credentials to include API Std 653 certification and qualification.

1.5.2.3 Piping Inspector

Qualification
Minimum five years verifiable experience performing fuel piping inspections of the same type as required. Provide evidence of having completed at least five similar inspections within the previous five years.

Certification
API 570 piping inspector. Provide Pipeline Inspector Credentials to include API 570 certification and qualification.

1.5.2.4 Non-Destructive Examination Company

Qualification
Independent third party company meeting requirements of ASTM E329 and ASTM E543. Verifiable experience conducting:

a. Bulk fuel storage tank examination
b. Plate scanning for surface, subsurface, and backside indications
c. Weld scanning for surface and subsurface indications
d. Thin plate (0.25 in) thickness measurement

Certification
Submit the name, address, and telephone number of the company selected to perform inspection-phase NDE of the storage tank. Provide NDE Firm Credentials to include industry qualification and experience.

1.5.2.5 Non-Destructive Examiner

Qualification
Examiners shall be qualified to perform non-destructive examination in accordance with API Std 653 and API Std 650. Examiners shall meet minimum requirements for qualification in ANSI/ASNT CP-189. Qualified examiners shall have minimum five years verifiable experience performing non-destructive examination of bulk fuel storage tanks. Examiners performing thickness measurements shall be experienced and skilled in the examination of thin steel. Experience is defined as work activity accomplished in a specific NDE method under the direction of qualified supervision including the performance of the NDE method but does not include time spent in training programs. Should an NDE examiner also be a welder, that individual is disqualified from inspecting or examining a weld or any portion thereof of the examiner's own work.

Certification
Examiners shall meet minimum requirements for certification in ANSI/ASNT CP-189. Provide examiners certified to at least Level II for the applicable method to be deployed. Level II Limited certification does not meet this requirement. Provide NDE Examiner Credentials to include qualification and certification.

1.5.2.6 POD Analyst

Provide an independent third party analyst experienced in POD analysis performed pursuant to ASTM E2862-12. Minimum experience is five years verifiable. Provide POD Analyst Credentials to include certification and experience.

1.5.2.7 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform metallurgical testing. Provide documents demonstrating current Laboratory Accreditation by A2LA.

1.6 DESIGN

Consult with experts experienced in Red Hill tank inspection and repair. Provide subject matter professional engineering expertise in the design.

1.6.1 Tank Plate Access

Design means and methods which provide access for personnel, materials, and equipment to all areas of the tank envelope. Design in accordance with ASCE 7, AISC 325, ASCE 37-14, EM 385-1-1, NAVFAC P-307, and 29 CFR 1926.1400. Address all inspection and construction loading conditions imposed on the lattice tower, bridge, and catwalk - including point loads - in the design. Brace and repair tower, bridge, and catwalk pursuant to Section 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS. Submit Tank Plate Access Plan in accordance with paragraph SUBMITTALS.

1.6.2 Environmental Conditions

Design ventilation and tank entry means which will provide a gas-free environment suitable for safe entry, and compliance with Section 33 65 00 CLEANING PETROLEUM STORAGE TANKS and API Std 2015. Consider all regions of the storage tank equivalent to a tank bottom and prepare for work in accordance with API RP 2207.

1.6.2.1 Gas Test Holes

Liquid or hydrocarbon vapor might exist in the tank shell to substrate interstice. Should the interstice be required to be sampled or inerted, provide an engineered detail to install test holes. Purge the interstice with inert gas if required to establish gas-free conditions and in accordance with API RP 2207. Provide test holes pursuant to paragraph GAS TEST HOLE INSTALLATION. Repair gas test holes in accordance with paragraph GAS TEST HOLE REPAIR..

1.6.3 Tank Geometric Data

Design a survey regime which will result in a thorough, survey-grade, electronic dataset of the tank hydraulic boundary and interior piping. Data shall be non-proprietary and conform to ASTM E2807-11. Point density

shall be adequate to provide surface resolution of 0.25 inch each axis. Data are intended for use as a permanent set of baseline information and to be registered with the inspection data. Ensure point cloud is supported directly within AUTOCAD software.

1.6.4 Destructive Testing

Design destructive testing which will test coupons and report chemical, mechanical, macrographic, and metallographic analysis of the material. Use the services of an accredited testing laboratory. Design the testing to inform the repair design, and perform weldability testing as required in Section 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS.

1.6.5 Storage Tank Inspection Design

Provide an engineered design of the storage tank inspection and other specialized engineering services. Incorporate inspection of components which fall outside the scope of API Std 653 and API 570, but which fall within the scope of this Section. Design the inspection to validate storage tank conditions during the design phase in order to fully inform the repair design. Produce professional design drawings, sketches, shop drawings, and specifications which are complete, usable, and compliant with FC 1-300-09N.

Specify complementary methods capable of detecting and sizing surface and subsurface defects, as well as product and backside corrosion. Qualitative methods are acceptable for screening purposes as long as requirements of this Section are met and quantitative data are obtained by follow-on means.

Design an approach which will examine 100 percent of the tank shell, hydraulic boundary, nozzles, cover channels, expansion joints, and welds. Tailor design to specific facility conditions. Address relevant damage mechanisms pursuant to engineering best practice and API RP 571.

1.6.5.1 Modified Inspection Approach Analysis

A modified approach is required in order to apply principles of API Standard 653 to the extent practicable and also assess unique characteristics of vintage mined storage tanks. Evaluate tank conditions through a systematic approach led by the Tank Engineer. Many original construction welds do not meet current standards and practices for geometry and spacing. Use engineering judgement when determining whether repair of existing fully-performing but noncompliant welds is warranted. Exercise care to inspect existing tank welds for subsurface or included indications.

Provide a Modified Inspection Approach Analysis (MIAA) which describes the engineering basis for an inspection. Adhere to principles of the API Std 653 Standard and TIA-222. Take into account the tank design and construction methods. Incorporate best engineering practice. Do not use a risk based approach. Analyze and submit the MIAA in accordance with Section 01 33 10.05 20 DESIGN SUBMITTAL PROCEDURES.

Provide the following components in the MIAA:

a. Identify inspection aspects which will deviate and those which will not deviate from the Standards. Analyze the planned means versus API Std 653. Provide a written reconciliation report of the analysis.

b. State which scanning technologies will detect backside corrosion, weld

surface indications, and weld subsurface defects.

c. Identify how tank scanning technologies are complementary.

1.6.5.2 Modified API Inspection

Design an inspection regime which implements this Section and principles of API Std 653, API RP 575, API 570, and API RP 574 to the extent possible.

1.6.5.3 Corrosion Rate

Organize thickness data into bottom, lower dome, lower barrel, upper barrel, and upper dome regions. Screen inspection data to distinguish progressive versus non-progressive indications. Calculate corrosion rates by two methods.

a. Calculate long term corrosion rates per region in accordance with API Std 653. Use 1/2 inch (bottom) and 1/4 inch (other regions) nominal thicknesses. Use only progressive indications in rate calculations. Report both product side and backside rates in mils per year.

b. Calculate through the end of a new 20-year service interval using a modified approach to API Std 653 straight line method. Use assumptions listed in Table 1 (thickness units in inches). Substitute 1/2 inch nominal thickness into the calculation for the bottom region.

Table 1 Modified Corrosion Rate Calculation

Thickness at the end of the original service interval	0.100
Nominal thickness	0.250
Original service interval start date	1942

1.6.5.4 Remaining Thickness Analysis

Calculate minimum plate thickness applying the approach in API Std 653 Minimum Thickness for Tank Bottom to all regions. Assume topside corrosion rate is zero. Use the corrosion rate calculated from values in Table 1 modified by a factor of safety of two. Report minimum thickness required to achieve, at the end of a 20-year interval, 100 mils of plate thickness at the modified corrosion rate. Do not use less than 160 mils as the repair threshold. If stress analysis is performed, use allowable stress values obtained from the pedigree analysis pursuant to paragraph DESTRUCTIVE TESTING. Report minimum thickness in mils per year.

1.6.5.5 Remaining Service Life

Classify relevant indications into mandatory, near term, and long term repair criteria. Apply requirements in paragraph SUITABILITY FOR SERVICE.

1.6.5.6 Tower, Bridge, and Catwalk

Design a modified approach to inspection of the lattice tower, bridge, and catwalk. Apply principles of TIA-222 to the extent applicable. Review the condition assessment checklist and design an inspection regime to provide

the basis for a structural analysis. Provide a structural analysis per TIA-222 to determine the overall stability and adequacy of structural members and connections. Use Structure Class II in TIA-222 Table 2-1. Attachment of mechanical equipment used to provide personnel access is a changed condition in accordance with TIA-222.

1.6.5.7 Vent Piping

Spiral welded pipe encased in gunite was used as tank atmospheric piping. Provide a digital format camera inspection of the pipe from the tank to the flange in the upper cross tunnel. Illuminate to allow a clear, infocus image extending at least five feet in front of the camera.

Use color camera with mininimum resolution of 1280 x 720, minimum interlaced frame rate of 24 frames per second, and capability to pan and tilt at least 360 x 270 degree. Equipment shall have a footage counter to record the camera distance in units of one-tenth of a foot.

1.6.5.8 High Stress Regions

Expected high stress regions in a Red Hill tank are the flat bottom, dome to filler or adjustment plate welds, bottom to first course welds, and bottom to tower leg welds. At minimum, examine the welds and heat affected zones with MT and BFET. Identify cracks, surface and subsurface indications, porosity, and deformation. After removing bottom coating, examine welds at the tower leg to bottom plate joints with SWUT. After construction loads have been removed from the tower, examine the same welds in accordance with SECTION 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS.

1.6.5.9 Expansion Joint and Adjustment Plate Joint

Design an inspection of the expansion joint and adjustment plate welds. Detect and size surface and subsurface cracks, pinholes, and porosity. Examine the seal weld between the stiffener plates for tightness. Examine the plug welds with MT. Leak test the joints with VBT. Do not perform diesel oil tests on the joints.

1.6.5.10 Strain Gauge Pipes

Remove the plugs in the strain gauge pipes. Test the space for hydrocarbon vapors. Design a low pressure vacuum test on the open pipe. Repair the strain gauge pipes per Section 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS.

1.6.5.11 Grout Nozzles

Determine and report whether grout pipe is packed full with grout. Test the space for hydrocarbon vapors. Design a vacuum test on the nozzle pipe.

1.6.6 Non-Destructive Examination

Design the examination to provide complementary non-destructive techniques. Do not rely on a single technology to detect a type of flaw. Procedures shall be compliant with ASME BPVC SEC V.

Design a regime of NDE which will result in a assessment of tank integrity. Consider all available technologies and techniques. Provide proven technologies with a demonstrable record of reliable results. Mitigate the limitations of each technology with a complementary approach tailored to the limitations. Ensure techniques, in the aggregate, have the

capability to detect flaws both at the minimum threshold as well as those of large volume, to include through holes.

Qualitative methods are acceptable for screening as long as requirements of this Section are met and quantitative data are obtained by follow-on means.

Record associated geometric data for each indication. Register data with the geometric dataset.

Consider the following inspection technologies: Magnetic flux leakage (MFL); Low frequency electromagnetic technique (LFET); Saturated low frequency eddy current (SLOFEC); Balanced field electromagnetic technique (BFET); Liquid penetrant (PT); Magnetic particle (MT); Ultrasonic examination (UT); Visual examination (VT); Vacuum box examination (VBT); Inline inspection (ILI); Ultrasonic shear wave (SWUT); Phased array ultrasonic (PAUT).

Specify VT, UT, and VBT techniques fully compliant with this Section, ASME BPVC SEC V, and API Std 650. MFL shall be compliant with API Std 653 Annex G. Adhere to NDE terminology in ASTM E1316-14. Provide an NDE Plan which includes requirements of ASME BPVC SEC V and:

a. Written procedures

b. Validation of equipment

c. Procedures to performance-qualify operators

1.6.6.1 Shell Plate Scan

In this Section, substitute the term "tank shell" for "tank bottom" as it is used in API Std 653 Appendix G. Design tank shell plate scanning to screen surfaces with LFET and in accordance with API Std 653 Appendix G. Specify UT at the corners of each plate and adjacent to welded obstacles. Prove up indications with an ultrasonic method.

Screen for arc strikes. At arc strikes, provide surface and subsurface examination to detect hardening or localized cracking.

1.6.6.2 Weld Examination

Design tank weld examination independent of shell plate scanning. Scan welds with BFET. Prove up indications with UT. Prove up linear indications with SWUT. Assess indications to identify conditions non-compliant with API Std 653.

1.6.6.3 Vacuum Box Testing

Design a procedure to test in two pressure increments. Start the test with a 2 psig differential. Maintain vacuum pressure for at least 10 seconds. Slowly increase to full pressure differential and maintain for at least 10 seconds.

1.6.7 Piping and Nozzle Inspection Design

Design an inspection of all tank process piping, appurtenances such as drain and sample lines, nozzles, flanges, valves, and steam piping. The intent of the inspection is to provide condition information, identify deterioration, and establish geometric data for the inaccessible piping.

Incorporate into the inspection design principles of API 570 and API RP 574.

1.6.7.1 Nozzle, Steam, and Drain Piping

Inspect the vertical and mitered portions of piping with a ultrasonic or electromagnetic method. Use a tethered or motorized approach to inspect the horizontal reaches. Use an instrumented tool which scans the entire circumference. Assess for metal loss, pits, cracks, or other indications. Qualitative technologies are acceptable for screening as long as quantitative data are obtained with an ultrasonic or ultrasonic shear wave technique. Tool uncertainty shall not exceed +/- 5 percent of wall thickness. Tool shall have the capability to detect an anomaly of depth 10 percent of wall thickness at a 95 percent confidence level.

1.6.7.2 Miter Joints

Examine the miter joint welds with an ultrasonic or ultrasonic shear wave technique. Detect surface, subsurface, and backside indications. Assess weld integrity.

1.6.7.3 Longitudinal Welds

The longitudinal joints are believed to have been manufactured with low frequency electric resistance welds. Scan the longitudinal seam welds for corrosion, weld inclusions, and cracks. Use an ultrasonic or ultrasonic shear wave technique.

1.6.7.4 Drain Line

Clean the drain line carrier piping interior surface to provide a suitable surface for the inspection. Inspect the drain piping with a videoscope. Provide an illuminated, articulating camera with mininimum resolution of 1280 x 720. Provide means to ensure the carrier pipe telltale is functional.

1.6.7.5 Tank Piping Hydrostatic Testing

Design a temperature compensated, volume - pressure change reconciled, combined strength plus leak hydrostatic test. Segments are issue, receipt, steam piping, drain line carrier pipe, and drain line piping. Design test in accordance with API RP 1110. Isolate test segments with suitable means. Steam piping and drain line carrier piping is not flanged. Use water as the test medium. Test pressure shall be 162.5 psig unless an alternative is authorized by the Contracting Officer. Do not exceed test pressure permitted by an ASME B16.5, carbon steel, ANSI Class 150 flange rating. Minimum test duration is eight hours.

Test shall be rigorous and analyze consistent error, inconsistent error, the magnitude of lost volume, and data trends. Inconsistent error able to be reconciled to less than 0.25 degree F is an acceptable result unless an alternative threshold is authorized by the Contracting Officer.

1.6.8 Design Submittals

Provide concept, design development, and For Construction design submittals. Submit Inspection Design pursuant to Section 01 33 10.05 20 DESIGN SUBMITTAL PROCEDURES

1.7 TANK RETURN TO SERVICE

Provide a plan to return the tank to the operator fit for service. Provide an approach which will ensure all dirt, abrasive material, and foreign objects are removed. Include a thorough cleaning of tank. The tank interior shall be as clean as possible without removing or damaging coating. Provide adequate time for curing of coating. Verify the vents are not covered and are operating properly. Tank cannot be returned to the operator until the suitability for service statement has been provided. Ensure requirements of NAVSUPGLSINST 10345.1 have been met.

1.8 SUITABILITY FOR SERVICE

Evaluate inspection data to determine suitability for continued use. Identify conditions which pose a threat to integrity. Set thresholds for mandatory, near term, and long term repairs.

In the determination of mandatory repairs:

a. Use a "first, do no harm" approach to classifying tank repairs.
b. Use 20 years as the interval to next inspection.
c. Minimum acceptable thickness shall be no less than 0.100 inch at the next inspection.
d. Do not repair conditions non-compliant with current standards which do not pose an integrity or structural threat (e.g., gouge, improper weld spacing, excessive weld profile).
e. Apply repair criteria to individual indications and not across an entire plate or course.

1.9 PROJECT/SITE CONDITIONS

1.9.1 Preparation for Inspection

Develop written procedures in accordance with API RP 575 for entry and re-entry into a storage tank. Ensure gas-generating, pyrophoric, or toxic residues have been removed. Review requirements in this Section and the inspection design to test the interstice for hydrocarbons and purge as necessary. Be vigilant to accumulation of dry pyrophoric material. Do not start inspection until storage tank has been certified by the Marine Chemist to be safe for entry and requirements of this Section and EM 385-1-1 have been met. Prepare for entry in a manner compliant with Section 01 35 26.05 20.

PART 2 PRODUCTS

2.1 QUALIFICATION TEST PLATE

Provide qualification test plate, in both vertical and horizontal configurations, pursuant to API Std 653 Annex G for POD examination. Size and type of induced flaws shall be representative of tank conditions. Ensure backside corrosion anomalies are fully represented. Quantify number, volume, and distribution of induced discontinuities. Secure test panel to ensure the integrity of the POD Examination, equipment qualification, and operator certification.

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Tank Piping Hydrostatic Testing

2.2.1.1 Testing Plan

Submit hydrostatic testing plan pursuant to Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES. Include:

a. Site specific test procedure
b. Description of the equipment, piping, and valves to be used
c. Method to secure test segment
d. Test record form
e. Method to determine acceptance
f. Method to characterize test water to screen for contaminants
g. Method to transport, store, and dispose test water

2.2.1.2 Hydrostatic Testing

Calibrate instruments and provide current certificates pursuant to API RP 1110. Provide means to remove entrapped air. Provide means of communication between technicians at each end of the test segment. Ensure test water contains less than 50 ppm chloride content.

2.2.1.2.1 Pressure Recording

Provide pressure recording instruments with an accuracy of at least +/- 1 psi. Ensure instrument accuracy exceeds the uncertainty required to achieve acceptance criteria. Utilize chart recorder to document pressure trends in addition to electronic data acquired for post-test calculations.

2.2.1.2.2 Temperature Recording

Measure test medium temperature independent of the environment. Provide instrument with output resolution of at least 0.1 degree F for water as the test medium. Ensure instrument accuracy exceeds the uncertainty required to achieve acceptance criteria.

2.2.1.2.3 Volume Measurement

Account for an accurate determination of fluid volume during a test. Provide volume measurements to the nearest fluid ounce.

2.2.2 NDE Reliability

Evaluate the reliability of NDE shell scanning by performing a Probability of Detection examination. Unless noted otherwise in this Section, terminology shall adhere to ASTM E2862-12.

Perform statistical analyses on POD examination data in accordance with ASTM E2862-12 and implementing principles of MIL-HDBK-1823A. The objectives are:

a. Quantify uncertainty in the detection of flaws for use in an assessment of the NDE system capability
b. Calibrate equipment to operate within the range of uncertainty
c. Validate equipment to verify it is operating within the range of uncertainty
d. Certify equipment operator capability to perform within the range of

uncertainty

2.2.2.1 POD Examination

Qualify plate scanning method(s) on test plates to generate hit/miss data per ASTM E2862-12.

2.2.2.1.1 Metal Loss (General) Qualification Test Acceptance Criteria

For areas of corrosion, the NDE system and operator shall detect metal loss, at a 95 percent confidence level, as given in Table 12.

Table 2 Detection of Metal Loss

Remaining Thickness, t (in) Original Thickness, T	Flaws Detected (Minimum Percentage)
t < 0.050	95
0.050 < t < 0.5T	85
0.5T < t < 0.7T	60
General Corrosion	100

2.2.2.1.2 Metal Loss (Pitting) Qualification Test Acceptance Criteria

For pitting, the NDE system and operator shall detect minimum tank shell wall loss, at a 95 percent confidence level, as given in Table 3.

Table 3 Detection of Pits

Pit Diameter, d (in)	Detectable Size (Percent Wall Loss)
d < 0.250	20
d >= 0.250	15

2.2.2.1.3 Crack Qualification Test Acceptance Criteria

The NDE system and operator shall detect a crack of width 0.025 in with a 95 percent confidence level.

2.2.2.2 Dimensional Uncertainty

Calibrate equipment and train operators to reliably estimate metal loss, discontinuities, and flaw dimensions. Analyze the sizing techniques. Determine and report the variability in NDE results. Variability shall not exceed 20%.

2.2.3 NDE Equipment

Qualify NDE equipment by testing on a qualification test plate. Demonstrate the capability of equipment to detect flaws at the threshold demonstrated during the POD Examination.

2.2.4 NDE Examiner Certification

Within 6 months of start of NDE, certify each NDE examiner by testing on a qualification test plate. Demonstrate the capability of each operator to detect flaws at the minimum threshold demonstrated during the POD Examination. Demonstrate the capability of each examiner to size flaws at the limits of dimensional uncertainty. Produce a certificate of competency for the technology and area of expertise of each examiner. Re-certify examiners should conditions in tank be different than the test panel, NDE results exceed the expected detection uncertainty, or at the request of the Contracting Officer. Re-certify each examiner at minimum every six months.

2.3 DATA MANAGEMENT

The geometry survey and tank inspection will result in a large point cloud. Establish a non-proprietary professional data management system which will result in secure, auditable, and organized data. Serialize all NDE and API inspection indications with a system of records. The system shall have the capability to easily be searched to track the provenance of repairs back to indications.

Label tank row and plate number information on tank plates in a neat and professional manner for orientation and photographic purposes. Do not use fluorescent paint in the tank.

Categorize indications pursuant to definitions in ASTM E1316-14.

2.4 TANK RETURN TO SERVICE

In accordance with Section 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS.

PART 3 EXECUTION

3.1 CONTROL OF HAZARDOUS ENERGY

Prior to entry, provide proper lockout and tagout of the storage tank and appurtenances to completely isolate from sources of energy. Items to be isolated include nozzles, valves, pumps, and motor starters. Isolate tank and piping with physical means such as blind flanges compliant with ASME B16.5 or line blanks compliant with ASME B16.48 to prevent fuel transfer into the tank or piping. Do not use isolation or control valves as means of isolation. Execute in accordance with accepted Accident Prevention Plan, Section 01 35 26.05 20 GOVERNMENT SAFETY REQUIREMENTS FOR DESIGN-BUILD and EM 385-1-1.

3.2 TANK PLATE ACCESS

Install robust means of access to all areas of the tank envelope for personnel, materials, and equipment. Provide access to the work, coordinated with Installation Safety, for the Contracting Officer representative while work is being performed.

3.3 GAS-FREE ENVIRONMENT

Degass tank until requirements of Section 33 65 00 CLEANING PETROLEUM STORAGE TANKS, the accepted Accident Prevention Plan, API Std 2015, 29 CFR 1910.146, and the certified Marine Chemist are met. Use care to ensure the upper dome cover channels do not contain liquid or hydrocarbon vapor. Obtain gas-free certification from the Marine Chemist. Maintain

the gas-free environment. Purge the interstice with inert gas as-needed to remove hydrocarbon vapors and comply with API RP 2207.

3.4 TANK CLEANING

Clean tank in accordance with this Section and SECTION 33 65 00 CLEANING PETROLEUM STORAGE TANKS. The interior surfaces shall be cleaned not to bare metal but only to the sound surface of the coating, free of rust, dirt, scale, loose material, fuel, oil, grease, sludge, and other deleterious material. Do not damage the sound existing coating material. Remove unsound or disbonded coating and clean the surfaces exposed to bare metal.

Use only fresh water under pressure. Maximum allowable pressure on coated surfaces is 200 psig. Maximum temperature of wash water is 135 degrees Fahrenheit.

Clean a representative test panel with the planned procedure. Examine to determine whether damage to coating resulted from the procedure. Adjust procedure to incorporate results of test panel. Provide test panel access to the Contracting Officer to review test. Report Cleaning Test Panel Results.

3.5 GAS TEST HOLE INSTALLATION

In the event verification of conditions in the interstice is required and pursuant to Marine Chemist requirements, install gas test holes in accordance with the inspection design and hot work permit. Drill with a pneumatic tool using cooling lubricant. Test hole diameter shall not exceed 3/16 in. Record all gas test hole locations in the indications database with a serialized identifier. Mark all test hole locations on the tank shell in a neat and professional manner. Repair gas test holes in accordance with paragraph GAS TEST HOLE REPAIR.

3.6 GEOMETRIC SURVEY

Establish an identifiable and repeatable control network. Provide dataset of all tank hydraulic surfaces and interior piping. Screen, edit, and re-survey data as-needed. Remove artifacts, noise, and data voids. Locate tower, catwalk, and structural features.

3.7 PHOTOGRAPHIC DOCUMENTATION

Document conditions with thorough photographic means and minimum capture resolution of 2560 x 1920. Only downsample images for reporting purposes. Provide full resolution images in electronic format on portable media. USB flash drives are not allowed. Include photographs which document the condition of the tank, general overall construction, and discrepancies.

3.8 STORAGE TANK INSPECTION

Arrive at site with all necessary equipment. Perform a thorough storage tank inspection in accordance with API Std 570, API Std 653, API RP 575, this Section, and pursuant to the engineered inspection design. Scan 100 percent of tank hydraulic surfaces to screen for discontinuities, flaws, anomalies, corrosion, cracks, gouges, delaminations, and other deviations in condition. Collect data to be used in the assessment of brittle fracture considerations, structural integrity, and hydraulic integrity.

Detect discontinuities, flaws, anomalies, corrosion, cracks, gouges, delaminations, and other deviations in condition.

Populate the database with inspection results. Ensure any gas test holes which were installed are recorded in the database. Distinguish between product-side and back-side indications. Categorize indications into corrosion-based and non corrosion-based indications.

3.8.1 Inspection Before and During Cleaning

Pressure washing can remove trace indications in areas requiring further examination. Perform a visual screening of the tank by the API Std 653 inspector prior to cleaning. Note areas of disbonded coating. Review the upper dome to determine whether product is present inside the cover channels. Review cleaning test panel to determine suitability of procedure. Provide oversight during cleaning to ensure excessive pressure is not applied to the coating system.

3.8.2 Tank Shell and Appurtenances

Examine flanges, weld cover plates, and grout nozzles. Pay particular attention to stitch welds, areas of incongruent geometry, corrosion at the grout nozzles, cover plate gaps, and weepholes.

Examine original plate seam welds and previous repairs. Pay particular attention to cracking in the heat affected zone and areas of minimal weld spacings. Note weld spacing which is non-compliant with API Std 653.

Note areas of bulges and out of roundness. Hammer test to detect substrate voids.

Examine shell structural penetrations for signs of stress, water intrusion, and corrosion.

Measure to determine tank gauge tube is plumb and centered over the datum plate.

3.8.2.1 Expansion Joint and Adjustment Plate Joint

Examine the adjustment plate joints and expansion joints. Use SWUT or MT to detect weld indications. Leak test the adjustment plate and expansion joints per paragraph VACUUM BOX TESTING.

3.8.2.2 Upper Dome Cover Plates

Carefully examine the seal welds on the cover channels for porosity or weld defects. Expect 1/8 inch mominal thickness of the channel material.

3.8.3 Structure

Examine the tank structure, columns, and joints. Assess whether there are signs of stress or water intrusion. Inspect all metal surfaces and metal components including piping and valves.

Inspect each leg of the tower structure for plumb and twist. Determine and report twist and out-of-plumb in accordance with TIA-222 Annex J. Perform a structural analysis of the tower and catwalk pursuant to TIA-222 Annex J.

3.8.4 Substrate

At each location where the concrete substrate is exposed for paragraph DESTRUCTIVE TESTING or for any reason:

a. Measure the alkalinity or acidity of the surface at two points. Do not clean the surface prior to measurement. Use a pH reading meter accurate to 0.01. Calibrate meter prior to use.

b. Lightly clean the surface. Examine the substrate for cracks, stains, spalls, or deterioration. Hammer test to detect delamination.

c. Document conditions with photography in accordance with paragraph PHOTOGRAPHIC DOCUMENTATION. Record location in geometric dataset. Report Substrate Test findings.

3.8.5 Vent Piping

Propel the camera through the pipe in a uniform manner which will not result in jerky movement. Adjust lighting intensity to minimize glare and picture quality to provide a clear, infocus image. Capture a full 360 degree view of the pipe interior. Record the inspection on portable digital media.

Produce a continuous color digital recording in MPEG 4 format with a minimum interlaced frame rate of 24 frames per second at minimum 1280 x 720 resolution.

Assess the camera inspection to identify areas of defects, corrosion, and damage. Generate still images from the system software of all relevant indications. Serialize and report relevant indications in spreadsheet format. Provide still images in JPEG format at minimum 1280 x 720 resolution, annotated with the associated footage and clock position, for each relevant indication.

Submit inspection data on a DVD containing the spreadsheet, video, and photo files in accordance with Section 01 33 10.05 20 DESIGN SUBMITTAL PROCEDURES.

3.8.6 Drain Line

Deploy wire brush, urethane, and magnetic tools to clean the drain line interior surface to be suitable for inspection. Use detergent in accordance with SECTION 33 65 00 CLEANING PETROLEUM STORAGE TANKS if water by itself is inadequate to remove fuel residue. Inspect the drain line pursuant to the inspection design. Inspect casing telltale to determine functionality.

[3.8.7 Coating Inspection

Provide an internal coating condition survey (CCS) by a NACE Certified Protective Coating Specialist (PCS). Do not perform CCS on coating which will be removed. PCS minimum qualifications are provided in Section 01 45 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL. PCS who is providing the CCS shall have verifiable experienced in the field of coating analysis, coating failure analysis, and coating design. Submit qualifications and experience of the proposed PCS and the CCS report per Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES.

Use visual observations, non-destructive testing, and destructive means in the survey. Provide objective ratings of coating system conditions at various tank regions. Evaluate the degree of corrosion in accordance with ASTM D610. Assess coating adhesion, pulloff strength, hardness, and dry film thickness.

The CCS shall contain detailed observations and analytical data about the coating, its condition, and the substrate. Cite industry criteria applied in the survey. Minimum CCS report contents are listed below.

a. Existing coating conditions, including condition of coating film, and existence of potentially hazardous substances which may impact coating management (i.e. lead, cadmium, chromium)
b. Analysis of remaining coating life, suitability for overcoating, and technical requirements for overcoating
c. Other information of interest in management of the coating system such as surface corrosion, checking, chalking, adhesion, thickness, and blistering
d. Criteria citations for each aspect of the survey
e. Technical recommendations for cost effective management of existing coating systems, including management of any hazardous materials present in paint film.

][3.8.8 Coating Inspection

Provide an assessment of the tank coating system. Identify type and extent of existing coating. Identify locations of coating failure, disbondment, laminations, pitting, fish eyes, pinholes, blisters, and bubbles. Perform dry film thickness (DFT) measurements in accordance SSPC PA 2. Measure DFT on the barrel and upper dome regions at 30, 50, 65 and 80 percent heights. Organize the DFT data into tabular form. Identify the minimum, maximum, and average thickness obtained from the regions. Register the thickness measurements with tank geometric data.

]3.8.9 Engineering Assessment

Use the data obtained during the inspections to perform an engineering assessment of the hydraulic and structural conditions of the storage tank and its appurtenances. Determine and report product and backside corrosion rates for regions of the tank. Calculate the remaining service life.

3.8.10 Protect in Place

Protect in place tower, catwalk, piping, and ATG probe and conductors. Mark indications and inspection information on tank plates in a neat and professional manner. Do not use fluorescent paint in the tank.

3.9 NDE TECHNIQUES

3.9.1 Visual Examination

Visually inspect the overall condition of the tank. Include manway cover, atmospheric vent system, dome, bottom, and barrel plates. Assess corrosion, coating condition, welds, appurtenances, gauging, nozzles. Apply API RP 575 recommended practices for performing a tank inspection. Enhance visual acuity with a magnifying lens of 5X to 10X power wherever required to discern indications otherwise not clear. Measure size and contour of welds with suitable gages. Minimum light intensity at the examination surface shall be 100 foot-candles. The VT procedure shall be

compliant with ASME BPVC SEC V. The VT acceptance standard for welds is API Std 650.

3.9.2 Tank Shell Scan

Scan all tank shell surfaces for indications such as wall loss, pits, cracks, gouges, and general corrosion. Qualify operators and equipment according to paragraph NDE RELIABILITY. Distinguish between product and backside thinning and indications.

Quantify indications with an ultrasonic method. Be vigilant to detect large areas of uniformly-corroded metal and laminations. In areas inaccessible by scanning, use UT to characterize condition.

3.9.3 Weld Scan

Scan welds and heat affected zones to detect surface and subsurface indications. Be vigilant to detect linear indications. Identify in the serialized dataset weld indications which are linear, subsurface, or backside.

3.9.4 Thickness Measurement

Perform measurements of the tank shell and nozzles with a volumetric method. Procedures shall be compliant with ASME BPVC SEC V. Record measurements, exclusive of coating, for tank bottom plates, and each lower dome, barrel, expansion joint, and upper dome plate. In addition, provide UT thickness measurement on no less than 5 random locations per plate and at indications determined to be relevant from the screening technologies.

Mark relevant indications on tank surfaces in a neat and professional manner. Register UT data locations with geometric dataset.

3.9.5 Vacuum Box Testing

Remove coating on floor, lower dome, and barrel to 40 inches above the lower dome to barrel joint. Perform VBT on locations in the tank where a breach in the hydraulic boundary is suspected. Using a specialty apparatus, perform VBT around the adjustment plate and expansion joint edges. Minimum light intensity at the examination surface shall be 100 foot-candles. Use a procedure compliant with this Section and ASME BPVC SEC V. Evacuate the vacuum box slowly. During the test, elevate differential pressure slowly from low to high. Do not increase vacuum during active bubble formation. The VBT standard for acceptance is the no leak condition and API Std 650.

Perform VBT on the upper dome cover channels to determine whether the seal welds are tight.

Mark relevant indications on tank surfaces in a neat and professional manner. Register VBT test locations with geometric dataset. Repair areas of removed coating in accordance with SECTION 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS.

3.10 PIPING AND NOZZLE INSPECTION

Using a Piping Inspector, perform an piping inspection of the tank nozzle, drain line, and steam piping using the principles of API 570 and API RP 574. For areas determined to require further investigation, provide Fitness for

Service evaluation pursuant to API RP 579-1 assessment methodology.

Examine piping couplers, expansion joints, reducers, and means of vibration isolation with regard to suitability and serviceability. Evaluate whether the devices are serviceable and capable of performing the function for which they were intended.

3.10.1 Tank Piping Hydrostatic Testing

Notify the Contracting Officer 14 days prior to hydrostatic testing. Hydrotest tank nozzle, drain line, sample line, and steam lines piping in accordance with API RP 1110 and the engineered design. Utilize the first flange inside the tank and the first accessible flange outside the tank as boundaries. Utilize alternative means to isolate the steam piping. Remove appurtenances within the test segment and isolate with blind flanges. Deploy components with pressure rating no less than existing flanges. Use water as the test medium. Maintain the pressure within the piping for the test duration with no leakage or reduction in gauge pressure. Synchronize temperature and pressure data log intervals.

3.10.2 Valves

Verify tank double block and bleed (DBB) isolation and control valves with regard to suitability and serviceability. Verify operation of all valve appurtenances including motor-operated equipment and position indicators. Clean, recondition, test, and commission the DBB valve and actuators back into service.

3.11 GAS TEST HOLE REPAIR

Repair all gas test holes pursuant to Section 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS. Fill every gas test hole with weld metal.

3.12 DESTRUCTIVE TESTING

After shell scanning has been performed and backside corrosion data reviewed, obtain five 8 in by 4 in coupons of tank shell material for testing. Coupon locations shall represent each region of the tank. Designate barrel coupon locations at sites with backside corrosion. Remove test coupons with a straight, neat, distortion-free cutline and in accordance with Section 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS. Assign one coupon to qualify weld procedure(s) in accordance with requirements in Section 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS.

Document coupon front and back side conditions with photography in accordance with paragraph PHOTOGRAPHIC DOCUMENTATION. Prepare samples and submit to laboratory for testing. In-situ testing is not acceptable as a substitute for laboratory testing. Use the services of an accredited laboratory to perform testing.

Perform chemical, mechanical, macrographic, and metallographic analysis of the coupons. Test mechanical properties pursuant to ASTM A370. Analyze carbon, sulphur, phosphorous, silicon, and other element content to determine an appropriate P-Number per ASME BPVC SEC IX, and to inform the weld plan pursuant to Section 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS. Provide carbon equivalent limits, ductility (Charpy impact), microhardness, yield stress, tensile strength, and microstructure examination.

Compare and contrast test results with ASTM plate material specifications.

Index properties with a modern standard per API Std 650 Section 4. Establish the allowable product stress and allowable hydrostatic test stress for use in API Std 653 Table 4.1 and to inform the minimum acceptable thickness calculations. Analyze and report results in the Pedigree Report. Submit Pedigree Report in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES.

Repair holes from coupons pursuant to Section 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS.

3.13 TANK CALIBRATION

Perform tank calibration in accordance with Section 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS.

3.14 DATA MANAGEMENT

Manage the database in a secure, auditable, and organized manner. Record visual and API inspection findings and associated geometric data in the system.

3.14.1 Data Integrity

Deploy data backup capability which will mitigate the security, integrity, and data loss risks of the database. Limit edit rights to individuals in a position of trust with a specific need. Provide physical and administrative safeguards which will ensure data integrity.

3.15 INSPECTION REPORT

3.15.1 Preliminary Report

Upon completion of the inspection for each tank, provide a preliminary report to the Design Manager. Submit Preliminary Inspection Report in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES. Preliminary report contents are:

a. Tank ID, location, and inspection date.
b. Suitability for service analysis pursuant to paragraph SUITABILITY FOR SERVICE, suitability for service statement identifying whether the tank is suitable for continued operation, reduce capacity or complete removal from service. If tank is unsuitable for service, provide a concise description of the reason(s).
c. Inspector of Record name, certification number, and date.
d. Storage Tank Engineer name, license number, and date.
e. Summary of tank, nozzle, and appurtenance conditions.
f. Structural analysis of tower and catwalk.

3.15.2 Full Inspection Report

Deliver a full report of inspection findings to the Contracting Officer. The report shall include a record of NDE findings with scale drawings depicting plate layout and thickness measurement locations. Incorporate engineering analysis, suitability for service analysis pursuant to paragraph SUITABILITY FOR SERVICE, corrosion rate determinations, and remaining service life calculations. Include electronic appendices with inspection and geometric data. Provide separate report for each tank inspected. Provide Tank Inspection Summary Sheet for each tank inspected. Define all terms including adjectival descriptions. Submit Inspection

Report in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES.

3.15.2.1 Executive Summary

Provide a one page summary of the condition of the tank and concise recommendations for repairs.

3.15.2.2 Suitability for Service Statement

This statement shall be a one page document. Specify the due date for the next inspection. Include the API 653 inspector of record certificate number and signature as well as the tank engineer's seal and signature. Provide a statement for each tank inspected. In the event the statement cannot be made, document the reason(s) and recommend corrective measures.

3.15.2.3 Tank History

Establish a complete historical record of the tank. The record shall include as much information as possible and include:

a. Nameplate information
b. Products previously and currently stored in the tank
c. List of previous inspections
d. List and describe significant environmental (earthquake, hurricane) or operational (over-pressure, vacuum, mechanical damage, settlement) events
e. List and describe repairs or alterations performed (include significant drawings and executive summaries from other repair reports in the report appendices)
f. Other pertinent facts and data

3.15.2.4 Inspection Methodology

Provide a detailed description of the inspection methodology for each tank component inspected. Include MIAA. Identify type of inspection, equipment, and methods. Discuss corrosion rates, minimum thickness, remaining service life and hydrostatic testing methodologies. Explain how statistical significance was addressed and meaningful data were obtained.

3.15.2.5 Findings

Describe inspection and NDE findings for each component, bottom, lower dome, barrel, upper dome, tower, appurtenances, access ways, nozzles, and ventilation. Present corrosion rates, minimum thickness, and remaining service life calculations. Interpret hydrostatic test results. Discuss all findings. Summarize NDE data in the report body and provide complete NDE data in appendices.

3.15.2.6 Recommendations

Include recommendations. Categorize repair recommendations into Mandatory, Near Term, and Long Term. Accompany each recommendation with a completion date. Recommendations based on policy, criteria, standards, and regulations shall include citations.

3.15.2.7 Appendices

3.15.2.7.1 Data

Include all data collected during the inspection. Data shall be electronic, in tabular form, and be registered with tank geometric data.

3.15.2.7.2 API Checklist

Prepare a modified API Std 653 Appendix C checklist. Annotate items which are not applicable. Incorporate the relevant items from the tower condition assessment checklist. Provide checklist, field notes, and measurements taken by the tank inspector and checklist.

3.15.2.7.3 Drawings

Include tank plate drawings depicting control points, indications, bottom, domes, and roof plate orientation, appurtenances, and other significant tank features.

3.15.2.7.4 Photographs

Provide full resolution well-lit electronic color photographs which depict the area of interest. Provide a photoguide which contains descriptive caption for each photograph.

3.15.2.7.5 Calculations

Provide calculations consistent with API Std 653. Include corrosion rates, minimum thickness, next inspection date, settlement, and estimated remaining service life. Provide a sample calculation for each determination along with assumptions and references utilized.

3.16 NDE RELIABILITY REPORT

Compile the POD and reliability assessment analysis into a report. Comply with minimum report requirements in ASTM E2862-12. Clearly report the demonstrated POD for each technology. Submit an NDE Reliability Report pursuant to Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES.

3.17 TANK RETURN TO SERVICE

Provide in accordance with Section 33 56 18.00 20 REPAIR OF FUEL STORAGE TANKS.

-- End of Section --